



Needs Analysis: Project Based Learning and Digital Transformation of the Merdeka Curriculum IPA Terpadu Learning

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Abstract: This study aims to analyze gaps and provide recommendations in project-based learning and digital transformation of the Merdeka Curriculum in integrated science learning. The research method uses a mixed methods approach. Qualitative data analysis was conducted by reducing data, presenting data, and drawing conclusions based on the results of interviews and observations. Quantitative data were obtained from questionnaires. The results showed that: 1) the gap that emerged was still in the form of student activity levels; 2) teachers' skills in creating learning websites needed to be improved; 3) digital learning had been implemented inside and outside the classroom; 4) teachers had basic computer skills; 5) teachers actively participate in teacher professional development; 6) obstacles in the implementation of the independent curriculum include student interests and talents; 7) providing support for teachers to participate in professional development; 8) teachers as facilitators; 9) the allocation of learning time for each meeting must be more than 2 hours of lessons; 10) limitations of equipment and materials for science practicum learning. Project-based learning and digital transformation need to pay attention to increasing student activity, learning web training, adding learning time allocation, availability of equipment and materials, and professional development.

Keywords: Digital Transformation; IPA Terpadu; Merdeka Curriculum; Needs Analysis, Project Based Learning.

Introduction

The quality of human resources is strongly influenced by educational factors which are the foundation of all processes in advancing and developing humans. The field of education is seen as a strategic effort that contributes to the development of a nation. The progress of the education sector and the quality of planned and sustainable education determine the development of human resources and the quality of society (Qutni et al., 2021; Rofik et al., 2025). One of the efforts to advance the field of education is the implementation of an appropriate curriculum

containing a set of plans and arrangements regarding the education system that is able to adapt to the changes that occur.

After the Covid 19 pandemic, the government through the Ministry of Education and Culture implemented the Merdeka Curriculum in the implementation of education in educational units. In responding to this policy, teachers and schools are required to prepare available resources so that the implementation of the Merdeka Curriculum can be carried out properly.

The Merdeka Belajar curriculum needs to integrate the use of E-Learning technology which is a new

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mainstay in school learning (Rosidah et al., 2021). Through digital transformation efforts from previously conventional ones, it is also a demand for teachers and schools to be able to organize learning based on information technology. The impact of the presence of Information Technology in the field of education has greater potential for the advancement of learning (Granić, 2022). The use of information technology in teaching and learning has shown a positive impact (De' & Kaugi, 2023). Education units should begin to integrate and introduce information technology in learning (Darmawan, 2015).

The characteristics of IPA Terpadu subjects contain learning outcomes for students to have skills and scientific thinking about natural phenomena and understand the study of the interaction of living things with their environment. In line with (Jamaluddin et al., 2019; Ramdani et al., 2019; Seroto, 2012) the study of science includes natural phenomena and their relationships to form scientific attitudes and skills through discovery based on direct experience in everyday life.

Fulfillment of IPA Terpadu learning outcomes should be student-centered, one of which is by using experimental teaching methods which are part of the project-based learning model (Anggraena & Nisa Felicia, 2022; I Nasrulloh et al., 2021). Project-based learning emphasizes and focuses on the activities of students to work on projects or tasks and produce works or products (Nurhadiyah & Fitria, 2020). Student centered learning in science subjects places the teacher as a facilitator and students are required to construct their knowledge and skills independently. Teachers should implement student-centered learning in accordance with the Merdeka Curriculum (Tuerah & Tuerah, 2023).

Based on the results of interviews with IPA Terpadu subject teachers in junior high schools and MTs in Garut Regency, most of them stated that the implementation of the Merdeka Curriculum is faced with the challenge of needing to have digital technology skills and a learner-centered learning approach. This condition is strengthened based on the results of Mohammad Ihsan's research, which states that teachers are still confused and there are many component readiness needed to implement the Merdeka Curriculum (Febrianningsih & Ramadan, 2023). Furthermore, as an effort for digital transformation, of course, schools are also required to provide supporting resources including computer technology, internet networks, and adequate science laboratories. In facing the era of digital education, schools are faced with the challenge of limited technological infrastructure and teachers need to have digital skills to support an

independent approach to learning (Yustiasari Liriwati et al., 2024).

The problem-solving approach in this research is to conduct a needs analysis as an effort to gather information related to the gaps in project-based learning and digital transformation of IPA Terpadu learning in the Merdeka Curriculum. The choice of this solution is based on the fact that project-based learning and digital transformation contain several complex components that are interconnected and influence each other, so an assessment is needed using the need assessment technique to analyze needs. Need assessment is the process of defining needs and deciding what their priorities are (McNeil, 1990). Needs assessment as a method for gathering information about gaps and using that information as a basis for making decisions about priorities (Seels, B.B. & Glasgow, 1990).

Most previous research obtained through literature studies has only focused on the effectiveness and impact of project-based learning on science learning. This study analyzes the factors needed and provides recommendations for the implementation of project-based learning and digital transformation in schools, including indicators of technology use and integration, skill levels, barriers to access, teacher perspectives, professional development resources, leadership, needs and desires, and student-centered learning strategies. These indicators are considered very important to study for the success of teachers in implementing project-based learning and the efforts of schools and teachers to transform the learning process by integrating digital technology into integrated science subjects on an ongoing basis.

The purpose of this study is to analyze gaps in the implementation of IPA Terpadu learning and provide recommendations to schools and teachers regarding the application of project-based learning and digital transformation of the Merdeka Curriculum in IPA Terpadu learning. The importance of analyzing needs in learning should be carried out by teachers so that the learning program to be implemented can be directed and in accordance with needs (Iman Nasrulloh & Ismail, 2017).

Method

Type of Research

This research uses a mix method. This method is used to explore a certain natural phenomenon and collect detailed and in-depth information (Creswell, 2009). The choice of this method is based on the purpose of this study to describe, explore, understand, and analyze natural phenomena related to project-based learning and digital transformation of IPA Terpadu

learning in the independent curriculum in junior high schools and MTs in Garut Regency.

Time and Location of Research

The research was conducted in 2024 between June and October. The research participants involved 30 IPA Terpadu subject teachers at the junior high school level in Garut Regency. The sampling technique uses purposive sampling based on sample considerations that are considered appropriate or representative (Barratt & Lenton, 2015; Taherdoost, 2018). The criteria for teachers as research participants include (a) IPA Terpadu teachers, (b) IPA Terpadu teaching experience of 7 years and above, (c) have implemented project-based learning, (d) have implemented learning using information technology devices.

Research Instruments

The key instrument in qualitative research is the researcher (Mbaleka, 2019). Interview sheets, observation sheets, and surveys were validated by experts before being used in the study. The interview sheet was used to explore the phenomenon in depth through oral statements. Furthermore, the observation sheet was prepared based on the indicators that had been formulated to determine the implementation of learning. The survey was given to find out the experience of using information technology in learning. Research Stage. The research stages are divided into three phases, namely preliminary study, planning, and implementation. For more details on the research steps, see Figure 1.

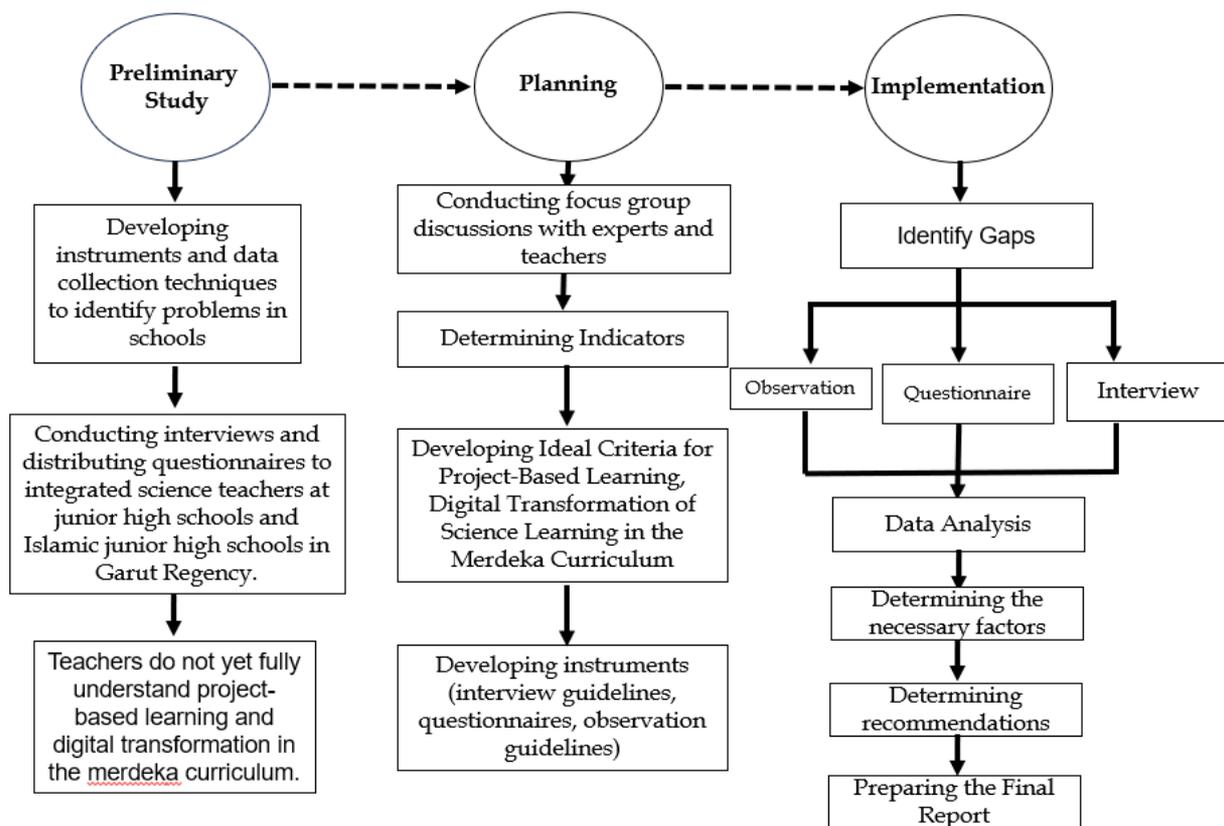


Figure 1. Research stage

Data Gathering and Data Analysis

Data collection techniques by triangulating methods including interviews, observations, and surveys aim to clarify the information obtained in depth. Data analysis by exploring findings or phenomena from several informants/respondents and data sources which

are then described into meaning (Morrow, 2015). The research study includes project-based learning and

digital transformation of the independent curriculum in IPA Terpadu learning.

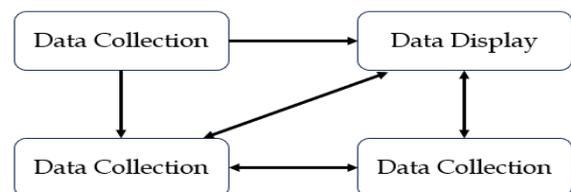


Figure 2. Data Analysis (Miles, M.B, Huberman, A.M, & Saldana, 1994)

Result and Discussion

Table 1. Aspect and Indicators

Aspect	Indicators
Project based learning	Teacher perception
	Instructional design
	Student characteristics
	Learning outcome assessment instruments
Digital transformation	Barriers
	Information technology skills
	Integration of information technology in learning
	Barriers and access to information technology
	Professional development

This study aims to identify gaps and provide recommendations for ideal components for the

implementation of project-based learning and digital transformation in integrated science learning under the merdeka curriculum. The research objects are divided into two aspects, namely project-based learning and digital transformation, which are explained in Table 1. The indicators were compiled based on the results of focus group discussions with IPA Terpadu teachers and curriculum experts, as well as relevant sources based on literature reviews.

Teacher Perception

This study reveals teacher perceptions aimed at knowing the teacher's perspective on project-based learning and digital transformation of the Merdeka Curriculum in IPA Terpadu learning. The following are the results of the teacher perception survey to 30 IPA Terpadu subject teachers

Table 2. Teacher Perspective Survey Results

Statement	Strongly Agree (%)	Agree (%)	Disagree (%)
Project-based learning is relevant to subjects IPA Terpadu	90	10	0
The use of information technology helps deliver information	80	20	0
Student centered learning is important in learning	77	23	0
The importance of having IT skills	83	17	0

A survey of 30 science teachers regarding teachers' perceptions stated that project-based learning is relevant to IPA Terpadu subjects. Based on the interview results, 60% of teachers reasoned that project-based learning is the right method to achieve IPA Terpadu learning outcomes in accordance with the Merdeka Curriculum, 20% of teachers reasoned that project-based learning introduces the stages of the scientific method to students, and 20% of teachers reasoned that students will learn to build knowledge and skills actively. Teachers feel helped by the presence of information technology, 80% or 24 teachers agree that using a computer can help in delivering subject matter and 83% or 25 teachers consider IT skills very important for teachers to have.

We believe that the success of project-based learning and digital transformation is influenced by teachers' perceptions. Teachers' perceptions of the

importance of digital transformation and project-based learning need to be understood in order to explore their views and efforts. One important factor in the success of the entire learning program, including the use of technology in education, is largely determined by how teachers perceive the technology (Anggraini, 2024; Stenbom & Geijer, 2025). A broader study found that teachers' positive perceptions determine their motivation to use information technology in digital transformation (Mahdum, M., Hadriana, H., & Safriyanti, 2019). Similarly, research findings (Khairani & Rifai, 2025; Renaldi, 2025) explore teachers' positive perceptions of the use of digital technology in learning based on their experiences, such as the delivery of learning materials, learning efficiency, and eliminating misconceptions. The researcher made observations during the learning process. The following are the results of observations during the learning process.

Table 3. Observation Results of Project Based Learning Implementation and Use of Information Technology

Indicators	Actual	Gap
Implementation of project-based learning in the classroom	All teachers have implemented project-based learning	Not there is gap and indicator fulfilled.
Learning using information technology	Most teachers use laptops with presentation media 40% use power point, 30% digital books/modules, and 30% smartphones.	Not there is gap and indicator fulfilled.
Learner-centered learning	Learners actively work on projects and cooperate in teams.	Not all students are active in learning, about 30-40% are inactive from an average number of 30-35 students.

Indicators	Actual	Gap
The teacher acts as a facilitator	Teachers provide facilities in the form of practical equipment, learning guides, and provide guidance.	Not there is gap and indicator fulfilled.
Use of multiple teaching methods	Teachers have used several teaching methods, including demonstration, experimentation, discovery, question and answer, and hands-on learning.	Not there is gap and indicator fulfilled.
The learning stages are in accordance with the learning design	The learning stages are in accordance with the learning design, including the initial activities (apperception), core activities, and final activities.	The implementation of project-based learning takes quite a long time, each meeting takes more than 80 minutes.
The teacher conducts product assessment as a result of the project	The teacher assesses the results of the project work that has been done by the students in groups. Students present the results of the project work.	Not there is gap and indicator fulfilled.
Appropriateness of learning time allocation	The learning time is appropriate, but the end of learning activities are slightly increased related to the presentation of the results of the project work that has been done by students	Overall the allocation of learning time is appropriate but needs to be added to the stages of the end of learning activities.

The importance of teacher perceptions of learning can affect the way teachers view, act, frame of mind, and activities that will be carried out by teachers during learning (Kurniawan et al., 2023). This statement is reinforced by the survey results (table 2) regarding teacher perceptions of the relevance of project-based learning to IPA Terpadu learning outcomes and the importance of using information technology in learning as evidenced by the results of observations (table 3) during learning has used *project-based learning* and information technology in learning.

Based on the results of observations (table 3), there are gaps during learning including 30%-40% of students are not active, learning time is not enough for 80 minutes or 2 lesson hours so that all groups have not been able to present the results of their projects, and need to add time to the end of learning activities so that teachers can optimize the initial activities and core learning activities. The problem of time allocation for IPA Terpadu learning is also a finding in research (Sumarmi, 2023), that teachers have difficulty managing the allocation of time for IPA Terpadu learning. In line with the results of research (Saparini et al., 2022) revealed that the allocation of time for IPA Terpadu learning is less or not enough because of the complexity of student and teacher activities. Teachers should be able to prioritize activities during learning so that learning time can be adequate and in accordance with the plan that has been set. According to the results of research (Ginting et al., 2024; Khaerunnisa et al., 2022), the complexity of science learning can be overcome if the learning is directed at student activities during the learning process so that the allocation of learning time can be fulfilled.

Instructional Design and Identify Learner Characteristics

Teachers design learning before the implementation of learning is carried out in class. Based

on the results of the interview, the first stage carried out by teachers in designing learning, 90% or 27 teachers stated that analyzing the independent curriculum includes understanding the independent curriculum implementation regulations, learning outcomes, flow of learning objectives, compiling learning tools, and compiling assessment instruments. In addition, which is the basis for designing learning, teachers identify the characteristics of students as learners including learning styles, learning experiences, and IT skills.

The Merdeka curriculum which emphasizes learner-centered learning and the role of the teacher as a learning facilitator, overall the teacher has carried out these functions and roles. Based on the results of the interview, the teacher's efforts as a learning facilitator are realized by providing teaching materials or learning resources to students to support students' learning activities independently, the teacher does not position himself as a source of knowledge, providing guidance during learning, providing facilities in the form of equipment and materials during the practicum, teaching materials integrate multimedia to facilitate the diversity of students' learning styles, and establish collaboration and teamwork between students during learning. In addition, the implementation of the independent curriculum mandates teachers and students to carry out the Pancasila Student Profile Strengthening Project (P5) which aims to provide freedom and independence to students in determining education according to their interests and talents.

The learning design prepared by teachers is guided by the independent curriculum containing the formulation of learning outcomes and teachers are required to understand students' learning profiles, interests, talents, learning styles, and learning needs (Sari et al., 2024). The characteristics of IPA Terpadu as a science subject include learning outcomes related to

scientific process skills, which require systematic lesson planning. Project-based STEM (Science, Technology, Engineering, and Maths) learning designs are an appropriate approach to apply in learning (Aliyah et al., 2025; Pratama et al., 2025). Identifying and understanding the characteristics of students is an important part of designing learning related to determining learning management strategies (Estari, 2020). Based on the results of interviews with IPA Terpadu subject teachers, overall teachers have compiled learning designs oriented to the characteristics of students and the fulfillment of learning materials according to learning styles and facilitating independent student learning activities.

Barriers

IPA Terpadu learning in junior and senior high schools in Garut Regency has implemented the

Independent Curriculum. Researchers revealed obstacles to the implementation of the independent curriculum and project-based learning with open questions to 30 IPA Terpadu subject teachers including limited equipment and materials for project-based learning, students' interests and talents, financing for the Pancasila Student Profile Strengthening Project, cooperation and collaboration between students, and preparation of process assessment instruments.

Information Technology Skills

Researchers uncovered teachers' skills in information technology by distributing questionnaires and interviews to 30 science teachers. The questionnaire contains closed statements with an alternative scale of 1-5 (1: not familiar, 2: beginner, 3: Average, 4: Continued, 5: expert). The following are the survey results regarding information technology skills.

Table 4. Information Technology Skills

Skills	Skill Level (% Responden)				
Word processing software (e.g., microsoft office word)	-	-	-	10	90
Email software (e.g., microsoft outlook, gmail, yahoo email)	-	-	3	10	87
Presentation software (e.g., microsoft powerpoint)	-	-	-	10	90
TV/computer monitor	-	-	-	10	90
Projector/laptop	-	-	-	10	90
Use of multimedia (text, images, audio)	-	10	33	30	27
Multimedia creation (audio, video, text, animation, hyperlinks)	-	13	50	20	17

Based on the survey results obtained, overall the IPA Terpadu subject teachers already have information technology skills with different levels. There are no respondents who do not recognize computer technology including software and hardware, meaning that all IPA Terpadu subject teachers have mastered basic skills in the field of information technology.

Integration of Information Technology in Learning

The use of information technology in learning that has been carried out by teachers illustrates efforts to

transform digitally. This research reveals the experience of teachers integrating information technology in IPA Terpadu learning through surveys and interviews with 30 subject teachers. The following are the results of surveys through questionnaires and interviews regarding the experience of teachers integrating information technology in learning. The questionnaire contains closed questions with alternative answers on a scale of 1-5 (1: Not at all, 2: Once a month, 3: Weekly, 4: Almost every class, 5: Every class).

Table 5 Experience of Information Technology Integration in Learning

Statements	Frequency (% Responden)				
Integrate computer technology in your teaching activities outside and inside the classroom	-	-	-	80	20
Integrate computer technology to assist with your administrative tasks as a teacher (e.g. attendance, grade processing, preparation of teaching plans)	-	-	-	17	83
Integrating computer technology in your professional collaboration activities. (e.g. knowledge sharing among colleagues, participation in training).	-	-	10	80	10

Researchers also revealed the function of information technology that has been used by teachers in the IPA Terpadu learning process outside and inside the classroom through a survey with closed questions

using a scale (1: Never, 2: Almost Never, 3: Occasionally, 4: Quite Often, 5: Very Often). Table 6 illustrates the function of information technology according to its designation that has been used by teachers.

Table 6. Information Technology Usage Activities

Function	Scale (% Responden)				
Communication (email, chat function, video conferencing, presentation media)	-	-	-	13	87
Organizational (e.g., databases, spreadsheets, note-taking, lesson plans)	-	-	50	26	24
Educational games	50	17	20	13	-
Expansive (e.g., simulations, experiments, exploratory)	27	23	33	17	-
Evaluative (e.g., assignments, digital portfolios, testing)	-	-	50	27	23
Informative (e.g., internet browsing, media clips, DVDs)	-	-	-	20	80
Other instructional (e.g., exercises, extra practice, tutorials, remediation)	-	-	27	50	23

The use of information technology is inseparable from the barriers and access felt by teachers. The phenomenon of barriers and access was obtained by conducting a survey to 30 IPA Terpadu subject teachers. The following are the survey results regarding obstacles

and access to the use of information technology using a questionnaire with closed questions and alternative answers (1: No obstacles, 2: Minor obstacles, 3: Major obstacles).

Table 7. Barriers and Access to Information Technology

Conditions	Scale (% Responden)		
Lack of classroom computers	90	10	-
Students do not have equal access to computers at home	80	10	10
Students' technology skills	70	30	-
Students do not have the English language skills	90	10	-
Insufficient or inadequate software on classroom computers or laptops.	77	13	10
Insufficient or inadequate support on how to use technology in my teaching	63	20	17
Computer unpredictability - computer freezes or software does not work properly	10	27	63
The type of computer and software at school is different to the computer and software I use at home	60	27	13
Internet is too slow or connection is lost	7	50	43

Professional Development

Teacher professional development is related to efforts and processes to improve understanding and skills. Formal education that has been taken by science subject teachers is not fully directed at mastering IT skills. This research reveals 30 IPA Terpadu subject teachers related to professional development as an effort that has been made by teachers to improve IT skills. The importance of developing teacher competencies in the current digital era is a must for teachers in order to adapt to the times and the demands of IT skills in the digital era (Sianturi & Putri, 2024). The following are the results of a survey of the time span for following professional development for 30 IPA Terpadu subject teachers.

Table 8. Time Span for Professional Development

	Time Period (% Responden)			
	Every month	1-3 Times in every semester	1-2 times every year	Never
Every week	27	50	23	-

The type of self-development through IT skills training makes a real contribution to teachers. The following are the types of professional development that have been carried out by 30 IPA Terpadu subject teachers and their relevance to the IT skills needed

Table 9. Time Span for Professional Development

Types of Professional Development	Response (% Responden)		
	Very relevant	Relevant	Not relevant
Managing desktop computers/laptops (opening programs, printing, etc.)	-	23	77
Learn to utilize network services efficiently (email, saving to server, searching for files, lms etc.)	50	30	20
Studying information sources on the internet	-	33	67
Integrating technology into student activities	77	16	7
Integrating technology into my classroom activities	70	27	3
Learning specific applications/software	80	20	-

Conclusion

Based on the research results that have been described, the implementation of project-based learning and digital transformation of learning can run well. There are gaps including insufficient learning time and students in learner-centered learning are not fully active. Teachers are required to prioritize activities during learning.

The obstacles in the application of project-based learning include the interests and talents of students, limited equipment and materials for practicum or experimentation. Professional development Overall, teachers have participated in training with different time periods. Teachers stated that IT skills training is very necessary in the current digital era and greatly affects the use of information technology during learning outside and inside the classroom.

Project-based learning and digital transformation need to pay attention to increasing student activity, learning web training, adding learning time allocation, availability of equipment and materials, and professional development.

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Author Contributions

Conceptualization, I.N, R.S.F, and I.M; methodology, I.N and R.S.F; instrument, I.N and R.S.F; investigation, I.N and I.M; data analysis, I.N, R.S.F, and I.M; results, I.N; conclusions, I.N. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

References

- Aliyah, H., Saputro, S., & Sarwanto, S. (2025). Implementation of Problem Based Learning-Science Technology Engineering Art and Mathematics Module to Improve Students' Science Process Skills. *Jurnal Penelitian Pendidikan IPA*, 11(7), 378-386. <https://doi.org/10.29303/jppipa.v11i7.11879>
- Anggraena, Y., & Nisa Felicia. (2022). *Kurikulum Untuk Pemulihan Pembelajaran* (Vol. 06, Issue 08). Pusat Kurikulum dan Pembelajaran Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi.
- Anggraini, S. (2024). Persepsi Guru Dan Siswa Tentang Penggunaan Media Pembelajaran Berbasis Teknologi Di Sekolah Dasar. *Jurnal Ilmu Pendidikan Dan Kearifan Lokal*, 4(6), 982-992.
- Barratt, M. J., & Lenton, S. (2015). Representativeness of online purposive sampling with Australian cannabis cultivators. *International Journal of Drug Policy*, 26(3), 323-326. <https://doi.org/10.1016/j.drugpo.2014.10.007>
- Creswell, J. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Sage Publications.
- Darmawan, D. (2015). *Teknologi Pembelajaran*. PT Remaja Rosda Karya.
- De', K., & Kaugi, E. (2023). Adoption of Information and Communication Technology in Teaching and Learning in Secondary Schools in Nairobi County, Kenya. *African Journal of Education and Practice*, 9(2), 15-37. <https://doi.org/10.47604/ajep.1960>
- Estari, A. (2020). Pentingnya Memahami Karakteristik Peserta Didik dalam Proses Pembelajaran. 32(3), 167-186. <https://doi.org/https://doi.org/10.20961/shes.v3i3.56953>
- Febrianningsih, R., & Ramadan, Z. H. (2023). Kesiapan Guru dalam Pelaksanaan Kurikulum Merdeka Belajar di Sekolah Dasar. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 7(3), 3335-3344. <https://doi.org/10.31004/obsesi.v7i3.4686>
- Ginting, D., Sabudu, D., Barella, Y., Madkur, A., Woods, R., & Sari, M. K. (2024). Student-centered learning in the digital age: in-class adaptive instruction and best practices. *International Journal of Evaluation and Research in Education*, 13(3), 2006-2019. <https://doi.org/10.11591/ijere.v13i3.27497>
- Granić, A. (2022). Educational Technology Adoption: A systematic review. *Education and Information Technologies*, 27(7), 9725-9744. <https://doi.org/10.1007/s10639-022-10951-7>
- Jamaluddin, J., Jufri, A. W., Ramdani, A., & Azizah, A. (2019). Profil Literasi Sains Dan Keterampilan Berpikir Kritis Pendidik Ipa Smp. *Jurnal Penelitian Pendidikan IPA*, 5(1). <https://doi.org/10.29303/jppipa.v5i1.185>
- Khaerunnisa, N., Jumadi, J., Indahsari, H. K., & Utami, A. R. (2022). Role of Parents and Tutors in Science Learning during Covid-19 Pandemic. *Jurnal Penelitian Pendidikan IPA*, 8(3), 1108-1113. <https://doi.org/10.29303/jppipa.v8i3.1279>
- Khairani, L., & Rifai, H. (2025). Integration of Edupark

- and Digital Technology : Analysis of the Need for a Physics Learning Website to Address Misconceptions. *Jurnal Penelitian Pendidikan IPA*, 11(11), 35-44. <https://doi.org/10.29303/jppipa.v11i11.12610>
- Kurniawan, W. R., Hartono, M., & ... (2023). Persepsi Guru Terhadap Pembelajaran Pendidikan Jasmani Dengan Protokol Kesehatan. ... *Pendidikan, c*, 62-86. <https://doi.org/https://doi.org/10.1529/kp.v1i5.131>
- Mahdum, M., Hadriana, H., & Safriyanti, M. (2019). Exploring teacher perceptions and motivations to ict use in learning activities in Indonesia. *Journal of Information Technology Education: Research*, 1(5), 18-25. <https://doi.org/https://doi.org/10.28945/4366>
- McNeil, J. (1990). *Curriculum: A comprehensive Introduction 4th edition.*, United States of America: Scott, Foresman/Little. Brown Higher Education.
- Miles, M.B, Huberman, A.M, & Saldana, J. (1994). *Qualitative Data Analysis, A Methods Sourcebook, Edition 3.* Sage Publications.
- Morrow. (2015). Psychological research as the phenomenologist views its: Existential phenomenological alternatives for psychological. In *University of Huddersfield*. University of Huddersfield Repository. <http://eprints.hud.ac.uk/id/eprint/26984/>
- Nasrulloh, I, Rahadian, D., Bariah, S. H., Purwanti, Y., & Imania, K. A. N. (2021). Development of an electronic book epub 3.0 as a learning resource for blended learning IPA Terpadu. *IOP Conference Series: Materials Science and Engineering*, 1098(3), 032115. <https://doi.org/10.1088/1757-899x/1098/3/032115>
- Nasrulloh, Iman, & Ismail, A. (2017). Analisis Kebutuhan Pembelajaran Berbasis ICT. *Jurnal Petik*, 3(1), 28-32.
- Nurhadiyah, A., & Fitria, Y. (2020). Pengaruh Model Project Based Learning (PjBL) terhadap Hasil Belajar Siswa Di Sekolah Dasar. *Jurnal Basicedu*, 5(5), 327-333. <https://doi.org/https://doi.org/10.31004/basicedu.v5i1.684>
- Pratama, H., Matsun, Puspitasari, Y. D., & Maduretno, T. W. (2025). Science Literacy through STEM-Based Project Based Learning Model. *Jurnal Penelitian Pendidikan IPA*, 11(7), 320-330. <https://doi.org/10.29303/jppipa.v11i7.11306>
- Qutni, D., Kristiawan, M., & Fitriani, Y. (2021). Human Resource Management in Improving The Quality of Education. *Edunesia : Jurnal Ilmiah Pendidikan*, 2(2), 354-366. <https://doi.org/10.51276/edu.v2i2.132>
- Ramdani, A., Jufri, A. W., Gunawan, G., Hadisaputra, S., & Zulkifli, L. (2019). Pengembangan Alat Evaluasi Pembelajaran Ipa Yang Mendukung Keterampilan Abad 21. *Jurnal Penelitian Pendidikan IPA*, 5(1). <https://doi.org/10.29303/jppipa.v5i1.221>
- Renaldi, R. (2025). Teacher and Student Perceptions Towards The Use Of Technology-Based Learning Media In High School. *Jurnal Kajian Ilmu Pendidikan (JKIP)*, 6(3), 919-926. <https://doi.org/https://doi.org/10.55583/jkip.v6i3.1448>
- Rofik, M. N., Munjin, & Wiyani, N. A. (2025). Human Resource Development through Education and Training: Literature Review and Applications in Organizations. *International Journal of Scientific Research and Management (IJSRM)*, 13(05), 2266-2278. <https://doi.org/10.18535/ijrm/v13i05.sh03>
- Rosidah, C. T., Pramulia, P., & Susiloningsih, W. (2021). Analisis Kesiapan Guru Mengimplementasikan Asesmen. *Jurnal Pendidikan Dasar, Vol 12 No(1)*, 87-103. <https://doi.org/https://doi.org/10.21009/jpd.v12i01.21159>
- Saparini, S., Andriani, N., Supardi, & Pasaribu, A. (2022). Hambatan Guru IPA dalam Menerapkan Pembelajaran IPA Terpadu di SMP Kelurahan Sukamoro. *Jurnal Literasi Pendidikan Fisika (JLPF)*, 3(2), 138-144. <https://doi.org/10.30872/jlpf.v3i2.1426>
- Sari, D. L., Amarta, M., Rifin, R., & Mustafiyanti, M. (2024). Rencana Pelaksanaan Pembelajaran Dalam Kurikulum Merdeka. *Jurnal Yudistira: Publikasi Riset Ilmu Pendidikan Dan Bahasa*, 2(3), 120-130. <https://doi.org/https://doi.org/10.61132/yudistira.v2i3.884>
- Seels, B.B. & Glasgow, Z. (1990). *Exercises in Instructional Design.* Merril Publishing Company.
- Seroto, J. (2012). Student Teachers' Presentations of Science Lessons in South African Primary Schools: Ideal and Practice. *International Journal of Educational Sciences*, 04(02), 107-115. <https://doi.org/10.31901/24566322.2012/04.02.04>
- Sianturi, M. V., & Putri, M. U. S. (2024). Pengembangan Kompetensi Profesionalisme Guru di Era Digital. *Jurnal Pendidikan Agama Dan Teologi*, 2(1), 180-190. <https://doi.org/https://doi.org/10.59581/jpat-widyakarya.v2i1.2221>
- Stenbom, S., & Geijer, L. (2025). Primary school teachers' perception of digital transformation and their teaching role. *Scandinavian Journal of Educational Research*, 69(5), 1131-1144. <https://doi.org/10.1080/00313831.2024.2394395>
- Sumarmi, S. (2023). Problematika Penerapan Kurikulum Merdeka Belajar. *Social Science Academic*, 1(1), 94-103. <https://doi.org/10.37680/ssa.v1i1.3193>

- Taherdoost, H. (2018). Sampling Methods in Research Methodology; How to Choose a Sampling Technique for Research. *SSRN Electronic Journal*, 5(2), 18-27. <https://doi.org/10.2139/ssrn.3205035>
- Tuerah, M. S. R., & Tuerah, J. M. (2023). Kurikulum merdeka dalam perspektif kajian teori: Analisis kebijakan untuk peningkatan kualitas pembelajaran di sekolah. *Jurnal Ilmiah Wahana Pendidikan*, Oktober, 9(19), 982. <https://doi.org/10.5281/zenodo.10047903>
- Yustiasari Liriwati, F., Marpuah, S., Wasehudin, & Zulhimma. (2024). Transformasi Kurikulum Merdeka Di Madrasah; Menyongsong Era Pendidikan Digital. *Jurnal IHSAN Jurnal Pendidikan Islam*, 2(1), 1-10. <https://doi.org/10.61104/ihsan.v2i1.103>